(2)

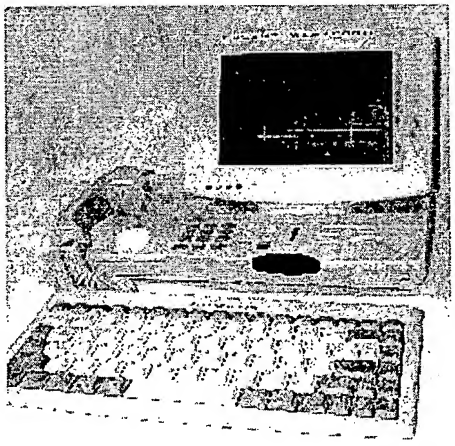
Lucent Web phone Prototype

A brief description of the hardware changes required to transform a shannon phone (Lucent/Philips IS2630) from dial-up Web phone into an IP enabled appliance supporting VoIP.

Definition

A Web phone is a cross between a single-board computer and a traditional telephone (an embedded computer mother-board with digital audio support, and a touch-sensitive screen). Some of the first web phones became available in Fall 1998 and in 1999, including the Philips IS2630 and the Alcatel Webtouch phones. Such devices combine a complete analog phone device and a diskless processor providing email, browser and a variety of organizer applications (call list and directory manager, notepad, calendar, etc.). These original analog Web phones are limited by the speed of dial-up modems, prohibiting VoIP.

The following hardware updates combined with a new (faster) version of the software have removed the original limitations of these devices and provide 10BT Internet access making these devices excellent Web-enabled business or home appliance to leverage the combination of voice services and data access within a small footprint. These IP Web phones are useful appliances to showcase emerging Lucent switching products and services.



Lucent Web phone

The IP Web phones are unlike today's personal computers, they are connected all the time, are always available to receive and send data. They restart (power up) and become operational in about 10 seconds, are ready for emergency calls, appear as robust and ubiquitous as POTS telephone. Yet the IS2630 IP Web phones use a StrongArm 1100 processor (Intel), 16 Mbytes of memory, 4 Mbytes of flash memory (for stored applications and data), a light weight custom Operating System (The Inferno OS on the IS2630) and an application suite providing: VoIP, browsing, email, software video rendering, and phone top applications.

Hardware Changes

The original IS2630 phones receive the following changes to enable IP data and voice services:

1. Hardware modification to reuse the existing DSP/Voice CODEC (apply it to capture and render packet audio) and redirect the resulting audio I/O to the existing analog voice system. This enables handset audio. and speaker phone (as well as existing volume control features) to work identically with packet audio or analog audio.
2. PCMCIA interface modification to support 5V (as well as the original 3.3V) enabling the use of a broader range of Ethernet access card.
3. Software changes include: audio driver (RTP/RTCP), media manager, telephony server, configuration manager (remote LSS provisioning), changed DSP driver, upgraded IP stack and selected Ethernet card driver.

A new "shanip" audio transfer board connects the DSP output back into the "shannon mongoose" board on the main PCB. This enables speaker and handset operation and volume control:

- Shanip additional board design
- Shanip board realization (front)
- Shanip board realization (back)

Resistor	Value	Capacitor	Value
R1	470	C1	1-10u
R2	4.7k	C2	47u
R3	120k	C3	.1u
R4 (init. mike att.)	1k (loud) 10k (low)	C4	1-10u
R5	4.7k	C5	1-10u
R6	5.6k	C6	1-10u
R7	220	C7	1-10u
R8	68	C8	.1u

Shanip PCB parts list

- Shannon main board (front)
- Shannon main board (back)
- Shannon SA1100 board (front)
- Shannon SA1100 board (back)

The connection to the front of the main shannon board uses an 8 wire color coded RJ-45 cable.

- Shannon main board DSP connection details

The color coding of the RJ-45 and RJ-11 (Aux. in back of phone) connectors follows this table:

PIN #	COLOR
1	blue
2	orange
3	black
4	red
5	green
6	yellow
7	brown
8	grey

RJ-11 and RJ-45 color code

The second slot of the PCMCIA interface (slot #1 - at bottom of phone) is modified to support optionally 5V PCMCIA cards. The second PCMCIA interface is set to 5V when the power lead is connected to the shanip audio board a J1 (using a 2 PIN JUMPER). Here are the hardware details of the PCMCIA changes:

- PCMCIA detail on SA1100 board (back)
- PCMCIA closeup 1
- PCMCIA closeup 2

The parts required for the above changes include:

Component	Type
T1	PNP >200MHz switching Transistor
D1	2V 10mA color LED
D2	.6V low voltage switching diode
C1	.1u
C2	220u
R1	10k
R2	100k

PCMCIA 5V bus upgrade parts list

A 5V PCMCIA Etherlink card is hard-wired to the Aux. port in the back of the phone. The Auxiliary port is used for thin ethernet connection to a 10BT LAN for example. Details of the PCMCIA wiring to PINS 1,2,3 and 6 of the RJ-11 female connector:

- PCMCIA card connection (front)
- PCMCIA card connection (back)

The shannon phone is then reassembled with the hardware changes:

- Shannon Web phone

Results

The IP Web phone experience is greatly enhanced over the original Web phone by the speed of direct Internet access, making this a very attractive device for service delivery to the business office via LAN or wireless LAN, or to the home via DSL, cable modem or high speed wireless.

For example, using a 10Base-T network interface card, an IP Web phone enables a quality audio call over IP to proceed unchallenged while very fast online information access is available (e.g. from a browser and while accessing email). In addition the phone functionality and software are seamlessly extensible to the network were servers can provide complimentary applications on demand.

Several (6) Lucent Web phone prototypes have been showcased at Lucent Full Circle conference in San Fransisco (May 15-18 2000). VoIP phone calls within the Lucent Intranet (between employee offices and lab using these prototypes began on June 7 2000. In March a first long distance call between Indian Hill and Huizen (Netherlands) was established using Lucent Softswitch. The call path used 32 routers had un-noticeable dealy at 10 am CDT. In May a first VoIP call was completed over our department's Broadband Fiber Access system (BFA).

Next Steps

The next generation of IP Web phones may well be enabled by a new IP phone platform provided by Lucent BCS. The new hardware based on Lucent Phone-On-A-Chip™ technology, uses USB (bus), enabling platform evolution towards video extensions, video conferencing device and the realization of broadband IP Web phones. Other considered designs include the Intel's Linux based Web phone platform. Samsung and UMEC may also provide suitable platforms.

In the mean time production of these phones has been very limited (modified and reassembled in a basement on spare time). We have a backlog of orders for Lucent employees and projects and a very small supply, we apologize for these delays. As other projects working on packet switching we recognize the need to have an IP phone development kit for Lucent employees, if only to be able to showcase Lucent's emerging packet switching products. (Getting tired of having to use MS Netmeeting to showcase Lucent emerging telephony services and products to customers? - We hear you.)

We have limited support for the shannon Web phones targetted for key projects with customer visibility (e.g. trials). As of June 19 2000, a new summer employee, Andres Hernandez will be working with us to assemble Web phones and perhaps we can start satisfying some of your needs.

Acknowledgements

A 1998 experiment at Bell Labs research project led by Venkatesh Krishnaswamy provided the first demonstration we saw of a Lucent prototype IP Web phones based on modified IS2630 Web phones. These IP Web phones enabled VoIP calls using the Lucent Softswitch from Bell-Labs research. We reused the results of this experiment (experimental shannon IP phone prototypes provided by Venky) to build the new enhanced version of the IP IS2630 Web phones.

If you have comments or suggestions, email me at *clarisse@lucent.com*

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